We claim:

1. A telechelic (co)polymer comprising polymerized units of one or more free radically (co)polymerizable monomers,

an first ring-opened azlactone terminal group; and

a second terminal group that is the residue of an organonitroxide.

2. The (co)polymer of claim 1 having a molecular weight distribution of less than 2.0.

3. The copolymer of claim 1 comprising two or more blocks of units obtained from free radically (co)polymerizable monomers, wherein the block copolymer has an azlactone residue at a first terminal end and, and the residue of an organonitroxide at the second terminal end.

4. The (co)polymer of claim 1 comprising polymerized units obtained from two or more radically (co)polymerizable monomers wherein the copolymer has a composition that varies along the length of the polymer chain from azlactone terminus to opposite terminus based on the relative reactivity ratios of the monomers and instantaneous concentrations of the monomers during polymerization.

5. The (co)polymer of claim 1, wherein said (co)polymer comprises polymerized monomer units selected from the group consisting of (meth)acrylic acid and esters thereof; fumaric acid and esters thereof; itaconic acid and esters thereof; maleic anhydride; styrene; α-methyl styrene; vinyl halides; (meth)acrylonitrile, vinylidene halides; butadienes; unsaturated alkylsulphonic acids and esters and halides thereof; and (meth)acrylamides, and mixtures thereof; said (co)polymer having an azlactone residue at a first terminal end of the (co)polymer chain and a residue of an organonitroxide at a second terminal end of the (co)polymer chain.

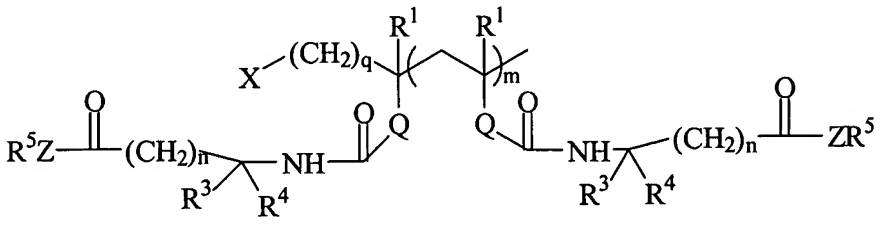
6. The (co)polymer of claim 1 having the structure

Az-$(M^1)_x$- $ON(R^2)_2$, wherein

$ON(R^2)_2$ is the residue of an organonitroxide;

M^1 is a monomer unit derived from a radically (co)polymerizable monomer unit having an average degree of polymerization x, , and

Az is a ring-opened azlactone group of the formula:



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wherein X is an H, an alkyl group, a cycloalkyl group, a heterocyclic group, an arenyl group, an aryl group, a nitrile, an acyl group or the residue of a free-radical initiator;

R^1 is H, an alkyl group, a cycloalkyl group, a heterocyclic group, an arenyl group or an aryl group;

R^3 and R^4 are each independently selected from an alkyl, a cycloalkyl group, an aryl group, an arenyl group, or R^3 and R^4 taken together with the carbon to which they are attached form a carbocyclic ring;

Q is a linking group selected from a covalent bond, $(-CH_2-)_o$, $-CO-O-(CH_2)_o-$, $-CO-O-(CH_2CH_2O)_o-$, $-CO-NR^6-(CH_2)_o-$,$-CO-S-(CH_2)_o-$, where o is 1 to 12, and R^6 is is H, an alkyl group, a cycloalkyl group, an arenyl group, a heterocyclic group or an aryl group;

each n is 0 or 1;

m is 0 to 20;

q is 0 or 1;

Z is O, S or NR^6, wherein R^6 is H, an alkyl group, a cycloalkyl group, an arenyl group, a heterocyclic group or an aryl group;

R^5 is an organic or inorganic moiety and has a valency of p.

7. The (co)polymer of claim 1 having the structure

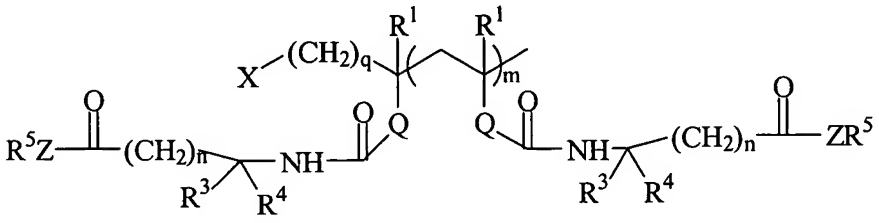
$Az-(M^1)_x(M^2)_x-(M^3)_x\ldots(M^\Omega)_x-ON(R^2)_2$, wherein

$ON(R^2)_2$ is the residue of an organonitroxide;

M^1 to M^Ω are each polymer blocks of monomer units derived from a radically (co)polymerizable monomer units having an average degree of polymerization x,

each x is independent, and

Az is a ring-opened azlactone group of the formula:



wherein X is an H, an alkyl group, a cycloalkyl group, a heterocyclic group, an arenyl group, an aryl group, a nitrile, an acyl group or the residue of a free-radical initiator;

R^1 is H, an alkyl group, a cycloalkyl group, a heterocyclic group, an arenyl group or an aryl group;

R^3 and R^4 are each independently selected from an alkyl, a cycloalkyl group, an aryl group, an arenyl group, or R^3 and R^4 taken together with the carbon to which they are attached form a carbocyclic ring;

Q is a linking group selected from a covalent bond, $(-CH_2-)_o$, $-CO-O-(CH_2)_o-$, $-CO-O-(CH_2CH_2O)_o-$, $-CO-NR^6-(CH_2)_o-$,$-CO-S-(CH_2)_o-$, where o is 1 to 12, and R^6 is is H, an alkyl group, a cycloalkyl group, an arenyl group, a heterocyclic group or an aryl group;

each n is 0 or 1;

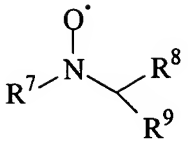
m is 0 to 20;

q is 0 or 1;

Z is O, S or NR^6, wherein R^6 is H, an alkyl group, a cycloalkyl group, an arenyl group, a heterocyclic group or an aryl group;

R^5 is an organic or inorganic moiety and has a valency of p.

8. The (co)polymer of claim 1 wherein the residue of the hindered organonitroxide, $-ON(R^2)_2$, is of the formula



wherein

R^7 is an alkyl group, a cycloalkyl group, an arenyl group, a heterocyclic group, an aryl group:

R^8, and R^9 are independently H, or an alkyl group, a cycloalkyl group, an arenyl group, a heterocyclic group, an aryl group, and R^7 and R^8, or R^8 and R^9, may be taken together to form a carbocyclic ring.

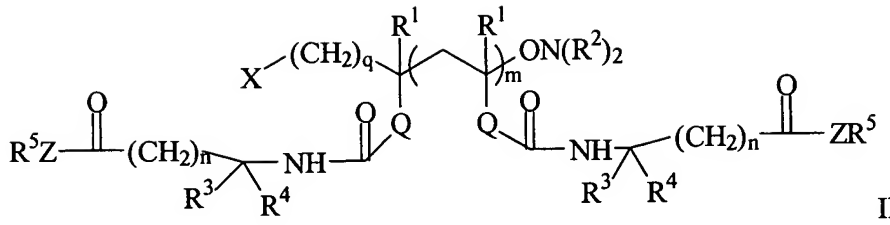
9. The (co)polymer of claim 1 wherein said R^5Z group is derived from a compound of the formula $R^5(ZH)_p$ wherein R^5 is an inorganic or organic group of valence p, and –ZH is selected from OH, SH or NHR^6, wherein R^6 is H, an alkyl group, a cycloalkyl group, an arenyl group, a heterocyclic group or an aryl group.

10. The (co)polymer of claim 1, wherein said R^5 group comprises metal- or nonmetal oxides having a plurality of –ZH groups on the surface.

11. The (co)polymer of claim 1, wherein said R^5 group comprises a non-polymeric aliphatic, cycloaliphatic, aromatic or alkyl-substituted aromatic moiety having from 1 to 30 carbon atoms.

12. The (co)polymer of claim 1, wherein said R^5 group comprises a polyoxyalkylene, polyester, polyolefin, polyacrylate, or polysiloxane polymer having pendent or terminal reactive -ZH groups

13. A method for preparing the (c0)polymer of claim 1 comprising addition polymerizing one or more olefinically unsaturated monomers using an initiator of the formula:



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wherein

X is an H, an alkyl group, a cycloalkyl group, a heterocyclic group, an arenyl group, an aryl group, a nitrile, an acyl group or the residue of a free-radical initiator;

R^1 is H, an alkyl group, a cycloalkyl group, a heterocyclic group, an arenyl group or an aryl group;

$ON(R^2)_2$ is the residue of an organonitroxide;

R^3 and R^4 are each independently selected from an alkyl, a cycloalkyl group, an aryl group, an arenyl group, or R^3 and R^4 taken together with the carbon to which they are attached form a carbocyclic ring;

Q is a linking group selected from a covalent bond, $(-CH_2-)_o$, $-CO-O-(CH_2)_o-$, $-CO-O-(CH_2CH_2O)_o-$, $-CO-NR^6-(CH_2)_o-$,$-CO-S-(CH_2)_o-$, where o is 1 to 12, and R^6 is is H, an alkyl group, a cycloalkyl group, an arenyl group, a heterocyclic group or an aryl group;

each n is 0 or 1;

m is 0 to 20;

q is 0 or 1;

Z is O, S or NR^6, wherein R^6 is H, an alkyl group, a cycloalkyl group, an arenyl group, a heterocyclic group or an aryl group;

R^5 is an organic or inorganic moiety and has a valency of p.

14. The method of claim 13, wherein m is 0, q is 0, and X is an H, an alkyl group, a cycloalkyl group, a heterocyclic group, an arenyl group, an aryl group, a nitrile, or an acyl group.

15. The method of claim 13, wherein m is 1 to 20, X is the residue of a free-radical initiator, and q is 1.

16. The method of claim 13 wherein R_1 is a C_1 to C_4 alkyl group.

17. The method of claim 13 wherein R_1 is H.

18. The method of claim 13 wherein at least one of R_3 and R_4 is a C_1 to C_4 alkyl group.

19. The method of claim 13 wherein R_3 and R_4 are methyl.

20. The method according to claim 13, wherein the addition polymerization is conducted at a temperature between 100 to 160°C.

21. The method according to claim 13, wherein the olefinically unsaturated monomers are selected from (meth)acrylic acid and esters thereof, fumaric acid and esters thereof, itaconic acid and esters thereof, maleic anhydride; styrene, α-methyl styrene; vinyl halides; (meth)acrylonitrile, vinylidene halides; vinyl pyridine; unsaturated alkylsulphonic acids and esters and halides thereof; and (meth)acrylamides, and mixtures thereof.

22. The method according to claim 13, wherein the polymerization is conducted neat or in a solvent.

23. The method of claim 22 wherein said solvent is selected from ethers, cyclic ethers, alkanes, cycloalkanes, aromatic hydrocarbon solvents, halogenated hydrocarbon solvents, acetonitrile, mixtures of such solvents, and supercritical solvents.

24. The method according to claim 13 further comprising a second polymerizing step using one or more additional olefinically unsaturated monomers.

25. The method of claim 13, wherein the initiator is present in a concentration of from 10^{-4} M to 1 M.

26. The method of claim 13, wherein the molar ratio of initiator and monomer(s) is from 10^{-4}:1 to 10^{-1}:1 of initiator to monomer(s).